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(12) UK Patent Application (19) GB (11) 2 323 336 (13) A

(43) Date of A Publication 23.09.1998

(21) Application No 9705453.0

(22) Date of Filing 17.03.1997

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(51) INT CL[6]
B60R 21/22 , B60N 2/42

(52) UK CL (Edition P)
B7B BSBNC B601

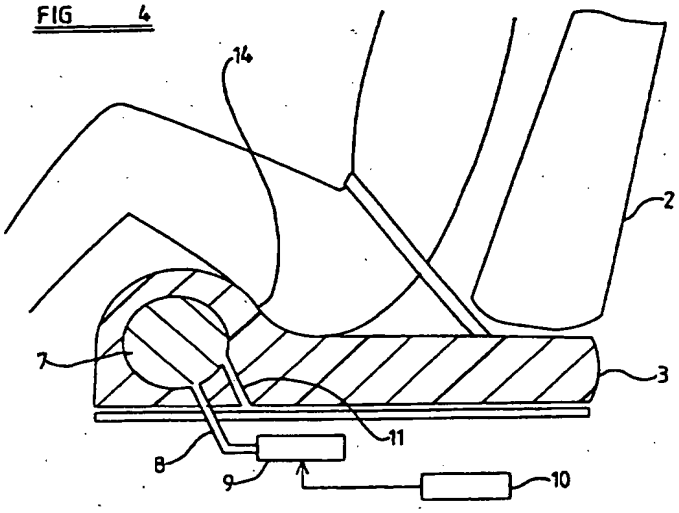
(56) Documents Cited
GB 2290505 A **GB 2284393 A** **WO 92/06861 A**
US 3853334 A

(58) Field of Search
UK CL (Edition O) **A4L LBEQ LBRG , B7B BSB**
INT CL[6] **B60N 2/42 , B60R 21/16 21/22**
Online: WPI

(54) Abstract Title
Inflatable cell in seat squab.

(57) To prevent passengers sliding or 'submarining' under a safety belt, the front portion of the squab 3 of a vehicle seat 1 has a cylindrical airtight cell 7 filled with resilient foam. The foam ensures that the seat is comfortable when the cell is deflated and vent passage 11 allows the cell to compress when sat upon. A gas generator 9 inflates the cell via passage 8 in response to a signal from accident detection means 10 and can either enlarge the cell or make it rigid without enlargement. Embodiments include three serially linked cells (Fig. 5) or a single large cell forming the front section of the squab (Fig. 6).

FIG 4



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

FIG 1

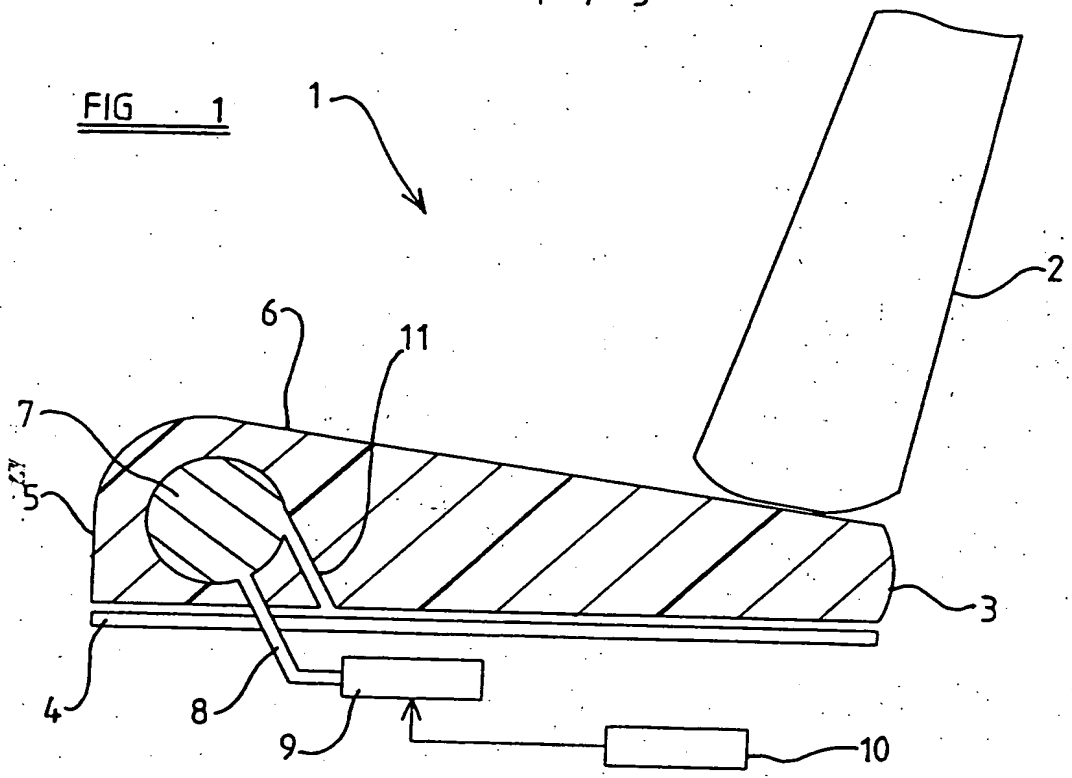


FIG 2

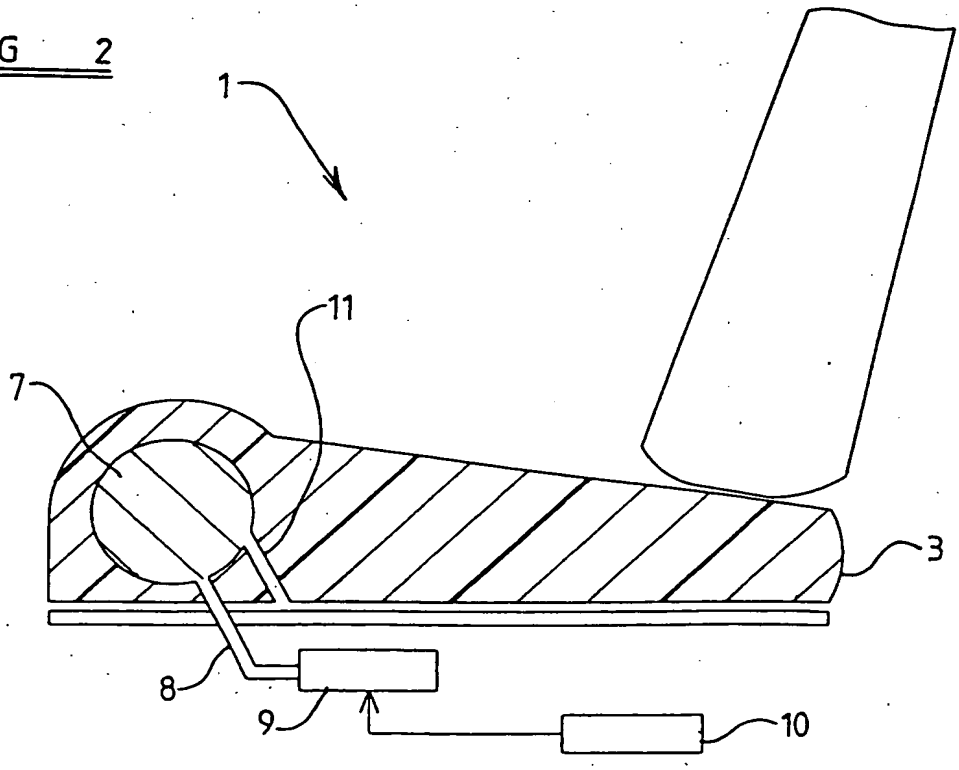


FIG 3

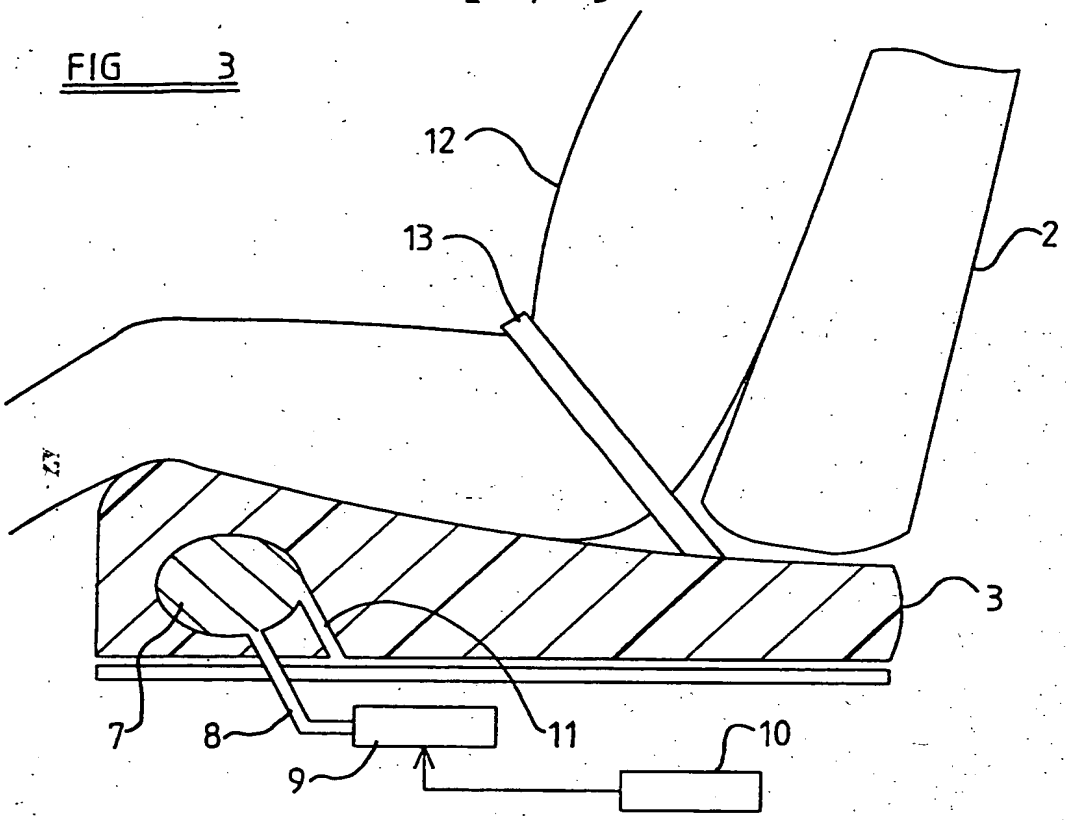


FIG 4

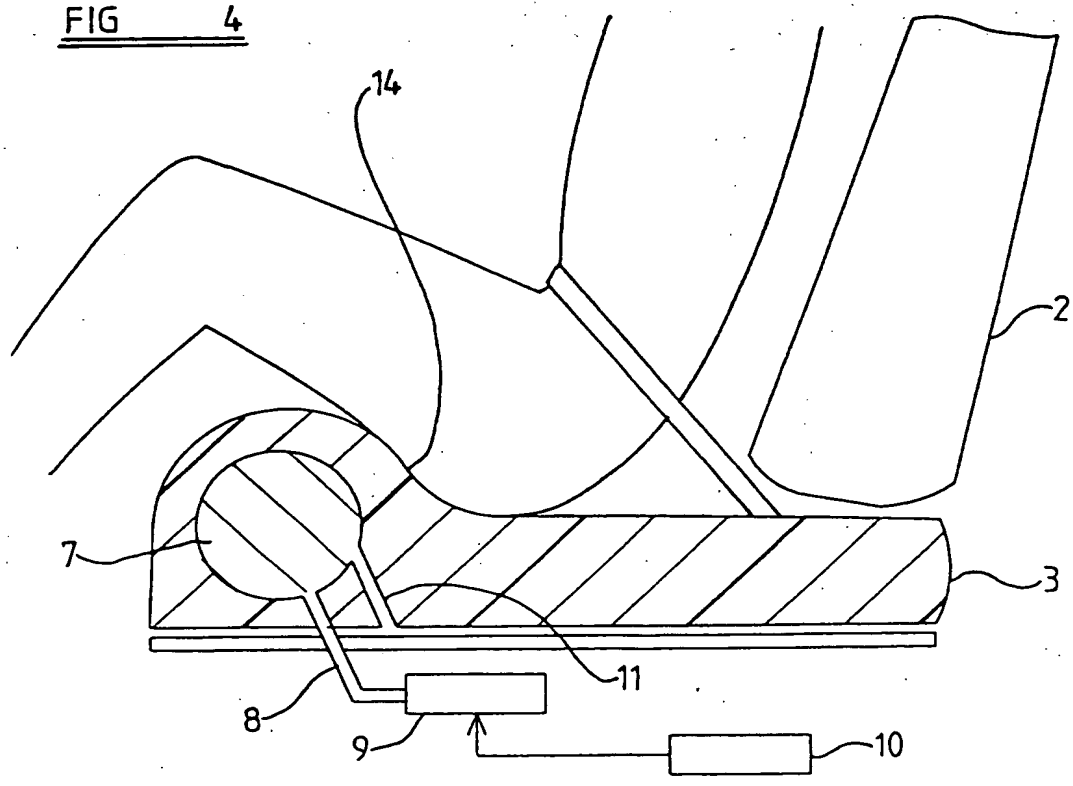


FIG 5

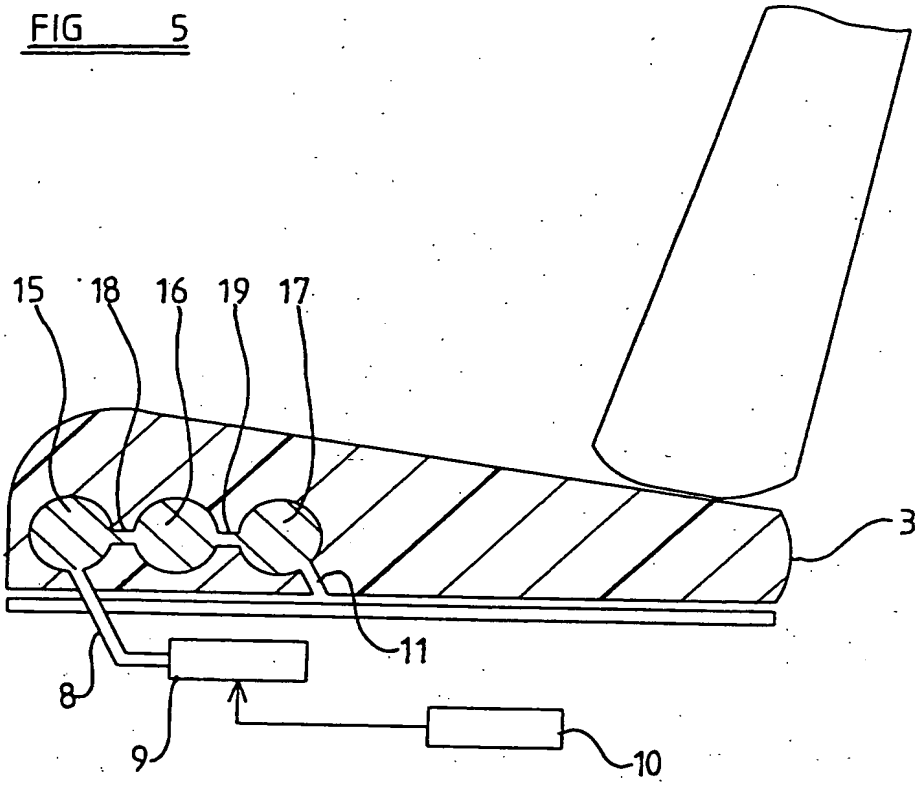
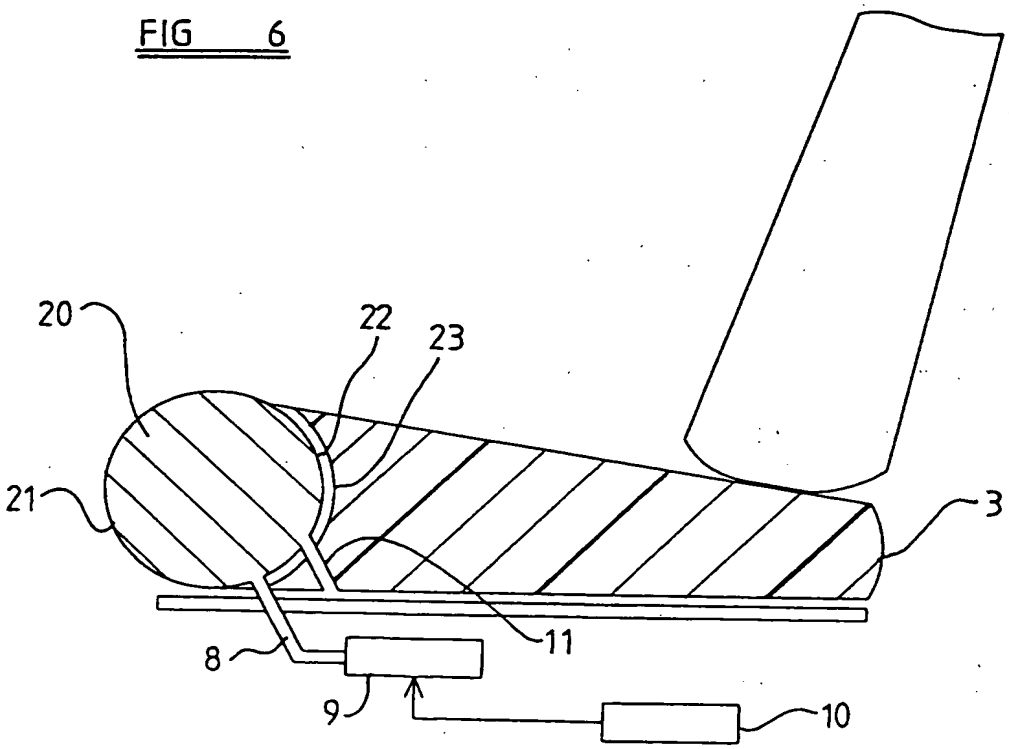


FIG 6



PATENTS ACT 1977

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DESCRIPTION OF INVENTION

"Improvements In Or Relating To A Vehicle Safety Seat"

This invention relates to a vehicle safety seat.

When a vehicle decelerates rapidly, for example during an accident, the occupants of the vehicle continue to move in a forward direction relative to the vehicle, due to inertia. Typically to prevent forward movement of a vehicle occupant from his seat a safety belt is provided in order to restrain the occupant. In such a typical vehicle it is not unknown for the lower part of the torso of the occupant to slide forwardly underneath the safety belt during a rapid deceleration. This forward movement beneath the seat belt is known as "submarining" and is undesirable due to the injuries sustained by an occupant as he impacts with the interior of the vehicle during such movement.

It is already known to provide means to raise the front of the seat squab relative to the back of the seat squab during a rapid deceleration. In this way the posterior of an occupant is "caught", before or while moving forward, to prevent submarining. A mechanism to move the whole squab as shown in WO94/04390, is technically complicated and expensive to manufacture.

It is also known to provide an air-bag under a seat cushion of a child safety seat for a vehicle, as shown in DE 4418028. When the air-bag is inflated, it lifts up the front part of the cushion to prevent the occupant from submarining. The problem with an air-bag of this type is that the very rapid inflation of the air-bag can injure the occupant.

The present invention seeks to provide an improved vehicle safety seat.

According to the present invention there is provided a vehicle safety seat comprising a squab having at least one substantially airtight cell in the front portion of said squab, said cell being filled with resilient foam, and means to inflate the cell in response to an accident situation.

Conveniently the means to inflate the or each cell includes gas generating means and means responsive to an accident situation to activate the gas generating means.

Preferably a single substantially airtight cell is provided.

Advantageously a plurality of substantially airtight cells is provided.

Conveniently the cells are of different sizes.

Preferably said cells are serially interconnected, said gas generating means being connected to one of said cells.

Advantageously the thickness of the or each cell is between 20% and 100% of the thickness of the squab.

Conveniently the gas generating means is adapted to inflate the or each cell to a pressure of between 30 and 50 kPa.

Advantageously the or each cell extends transversely across the squab.

Preferably the or each cell is of cylindrical form.

Conveniently the or each cell is located beneath part of the seat squab.

Advantageously the or each cell forms the front section of the squab.

Preferably the or each cell is contained within the squab.

Conveniently the out layer of the or each cell is airtight and is a woven or none-woven fabric or a flexible plastic material.

Preferably one or more vent passages are provided in the squab in order to connect the or each cell to the exterior of the squab in order to allow movement of air into and out of the cell in normal use.

Advantageously said one or more vent passages are of a diameter between 20 and 50mm.

Conveniently said means responsive to an accident situation is a deceleration detector.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a part-schematic cross-sectional view of a portion of a vehicle seat in accordance with the invention, in a first state;

Figure 2 is part-schematic cross-sectional view of the seat of Figure 1, in a second state;

Figure 3 is a part-schematic cross-sectional view of a portion of the seat of Figure 1 and an occupant, when the seat is in the first state;

Figure 4 is a part-schematic cross-sectional view of a portion of the seat and occupant, corresponding to Figure 3, in the second state;

Figure 5 is a part-schematic cross-sectional view of a portion of a vehicle seat comprising another embodiment of the invention; and

Figure 6 is a part-schematic cross-sectional view of a portion of a vehicle seat comprising a further embodiment of the invention.

Referring initially to Figure 1, a vehicle safety seat 1 comprises a seat back 2 whose base is connected to the back portion of a seat squab 3. The seat squab 3 is supported by a rigid supporting element 4 and has a front wall 5 and an upper surface 6. The main part of the squab 3 is formed of a monolith of a resilient foamed plastics material.

The seat is provided with means, which will be described in greater detail below which in the event of an accident make the front part of the squab of the seat rigid to minimise the risk of the occupant moving downwardly and forwardly. However, in normal use of the seat the said means are resilient and thus cannot be detected by the occupant of the seat.

A cylindrical cell 7 is provided, which is contained within the front portion of the seat squab 3. The cell 7 is located adjacent the front wall 5 and beneath the upper surface 6 and extends transversely across the squab 3. The cell 7 is filled with a resilient foamed plastics material with the openings in the foam being in communication with each other. The cell 7 has a volume of between 2 and 8 litres. The foam which fills the cell 7 has, under normal conditions, compression properties substantially identical to the foam forming the rest of the squab 3. The cell 7 is surrounded by an airtight outer layer which may be a woven or non-woven fabric or may be a flexible plastic material.

A conduit 8 extends from the cell 7 to gas generating means 9 which are located beneath the seat squab 3 so that gas can flow from the gas generating means 9 to the cell 7.

Detecting means 10 that are responsive to an accident, such as a detector to detect deceleration in excess of a predetermined threshold, are provided which are located adjacent the gas generating means 9 and which control activation of the gas generating means 9.

A vent passage 11, having a diameter of between 5 and 20mm, is provided in the squab 3 and connects the cell 7 to the exterior of the squab 3 adjacent the rigid supporting element 4. In an alternative embodiment, more than one vent passage could be provided.

In normal use, the vehicle seat 1 is in the position as shown in Figure 1. When an occupant 12 is sitting in the seat in normal use, restrained at the hips by a seat belt 13, the foam of the squab 3 and of the cell

7 is slightly compressed as is shown in Figure 3, where the uncompressed state of the squab 3 is shown in phantom. The vent passage 11 allows air to be squeezed out of the cell 7 in order to allow it to be compressed and so be comfortable for the occupant 12. Because the foam has similar compression qualities to the rest of the squab 3 in normal use, the vehicle seat appears, to the occupant, to be no different from a typical vehicle seat.

Should the vehicle be involved in an accident, the accident detecting means 10 generates a signal which activates the gas generating means 9. Gas is forced through the gas supply conduit 8 and into the cell 7. The influx of gas causes the cell 7 to be inflated to a pressure of between 30 and 50kPa and to become substantially rigid. Because the cell 7 is filled with foam which effectively maintains the cell 7 in a partly inflated state the exterior wall of the cell only moves through a relatively small distance, and with a relatively small acceleration, when the gas is supplied to the cell 7. Thus the risk of the cell 7 causing injury to an occupant of the seat as the cell 7 inflates, is minimal.

Some of the gas leaves the cell 7 by the vent passage 11, but this does not significantly reduce the rigidity of the cell 7 during an accident. When the cell 7 is pressurised, the vehicle seat appears as in Figure 2, or, when an occupant is sitting on the seat, the seat appears as in Figure 4. The front part of the upper surface 6 of the squab 3 is elevated relative to its initial position. It is to be appreciated that the rigid pressurised cell 7 presents a barrier to the posterior 14 of the occupant, should it move forward, thus preventing the occupant from slipping, or submarining, under the seat belt 13.

It is to be appreciated that, although pressurising the cell 7 increases the size of the cell 7, in an alternative embodiment of the invention, the cell 7 could become substantially rigid when inflated but remain the same size.

Referring now to Figure 5, an alternative embodiment of the invention is shown, those features common to the previous embodiment being given the same reference number. Three separate cells 15, 16, 17 are provided within the squab 3 and are interconnected. The cells 15, 16, 17 are cylindrical, being filled with the same foam and having the same outer layer as the cell 7 of the previous embodiment. Each cell is arranged with its long axis transversely across the front of the squab 3. The first cell 15 is contained within the squab 3, near the edge between the base and the front wall 5 of the squab 3. The gas flow conduit 8 extends from the gas generating means 9 to the lower surface of the cell 15. The second cell 16 is contained within the squab 3, behind the first cell 15 in horizontal alignment. A short pipe 18 joins the first cell 15 to the second cell 16. The third cell 17 is contained within the seat squab 3, behind the second cell 16 and in horizontal alignment with the first and second cells 15, 16. A second short pipe 19 connects the second cell 16 to the third cell 17. The vent passage 11 connects the lower portion of the third cell 17 to the exterior of the squab 3. Thus there is a chain of connection from the gas generating means 9, through the gas supply conduit 8, to the first cell 15, then the second cell 16, then the third cell 17 and finally to the vent passage 11. The three cells 15, 16, 17 may all be the same size, or may be of different sizes.

In this embodiment of the invention, in normal use, the vehicle seat 1 presents a comfortable seat for an occupant. When an occupant sits on the seat the three cells 15, 16, 17 are compressed, with air being expelled via the vent passage 11. When an accident is detected by the detecting means 10, a signal is generated which activates the gas generating means 9. Gas is forced through the gas supply conduit 8 to the first cell 15. The influx of gas causes the first cell 15 to become pressurised, inflated and substantially rigid. The gas then passes through the short pipe 18 connecting the first and second cells 15, 16, in order to pressurize and inflate the second cell 16, which subsequently becomes substantially rigid. The gas then passes through the pipe 19 connecting the second and third cells, 16, 17, in order to pressurise and inflate the third cell 17 so that it becomes substantially rigid. A small amount of gas then leaves the third cell 17 via the vent passage 11. Thus when an accident is detected the three cells 15, 16, 17, become rigid, with the first cell 15 being slightly more rigid than the second cell 16, which in turn, is slightly more rigid than the third cell 17. The three substantially rigid cells present a barrier to the posterior of an occupant of the seat, preventing submarining.

Referring now to Figure 6, a further embodiment of the invention is shown. Features which correspond to those features in the previous embodiments are given the same reference number. A cylindrical cell 20 forms the front section of the squab 3 and has its long axis located transversely across the squab 3. The front portion 21 of the cell 20 forms a rounded front wall of the seat, and the back portion 22 of the cell 20 lies adjacent a concave front wall 23 of the monolithic foam element that constitutes the rest of the squab 3. The squab 3 is

mounted on a rigid supportin element 4. The top of the front wall 23 is connected to a flat, rearwardly declining upper surface 6 of the rest of the squab 3. The radii of curvature of the curved surface of the cell 20 in normal use and the concave front wall 23 are such that they engage matingly. The gas flow conduit 8 connects the gas generating means 9 to the lower portion of the cell 20. The vent passage 11 joins the cell 20 to the exterior of the squab 3. The cell 20 is filled with foam and has an airtight outer layer as in the previous embodiments.

In normal use, this further embodiment functions as a normal vehicle seat, the cell 20 being compressible by expulsion of air via the vent passage 11, in order to be comfortable for an occupant.

When an accident is detected by the detector 10, a signal is generated which activates the gas generating means 9. Gas is forced through the gas flow conduit 8 in order to pressurise the cell 20. The cell 20 then becomes inflated and substantially rigid and presents a barrier to prevent forward and downward movement of the posterior of an occupant of the seat. Thus the occupant is prevented from submarining underneath his seat belt.

It is to be noted that in other embodiments of this invention different shapes and sizes of cell may be provided. The thickness of the cell may be between 20% and 100% of the thickness of the squab. It is also to be noted that, in embodiments where a plurality of cells are provided in a squab, many different configurations of the cells are possible. For example, there could be provided an array of connected cells in a "mattress" formation.

It is to be appreciated that the gas supply conduit 8 may be located in any suitable position that connects the gas generating means 9 to the cell 7. Similarly, the vent passage 11 may be located in any suitable position that connects the cell 7 to the exterior of the squab 3.

CLAIMS

1. A vehicle safety seat comprising a squab having at least one substantially airtight cell in the front portion of said squab, said cell being filled with resilient foam, and means to inflate the cell in response to an accident situation.

2. A seat according to Claim 1 wherein the means to inflate the or each cell includes gas generating means and means responsive to an accident situation to activate the gas generating means.

3. A vehicle safety seat according to Claim 1 or 2 wherein a single substantially airtight cell is provided.

4. A vehicle safety seat according to Claims 1 or 2 wherein a plurality of substantially airtight cells is provided.

5. A vehicle safety seat according to Claim 4 wherein the cells are of different sizes.

6. A vehicle safety seat according to Claims 4 or 5 wherein said cells are serially interconnected, said gas generating means being connected to one of said cells.

7. A vehicle safety seat according to any one of the preceding claims wherein the thickness of the or each cell is between 20% and 100% of the thickness of the squab.

8. A vehicle safety seat according to any one of the preceding claims wherein the gas generating means is adapted to inflate the or each cell to a pressure of between 30 and 50 kPa.

9. A vehicle safety seat according to any one of the preceding Claims wherein the or each cell extends transversely across the squab.

10. A vehicle safety seat according to any one of the preceding claims wherein the or each cell is of cylindrical form.

11. A vehicle safety seat according to any one of the preceding Claims wherein the or each cell is located beneath part of the seat squab.

12. A vehicle safety seat according to any one of the preceding claims wherein the or each cell is contained within the squab.

13. A vehicle safety seat according to any one of Claims 1 to 10 wherein the or each cell forms the front section of the squab.

14. A vehicle safety seat according to any one of the preceding claims wherein the outer layer of the or each cell is airtight and is a woven or non-woven fabric or a flexible plastic material.

15. A vehicle safety seat according to any one of the preceding claims wherein one or more vent passages are provided in the squab in order to connect the or each cell to the exterior of the squab in order to allow movement of air into and out of the cell in normal use.

16. A vehicle safety seat according to Claim 15 wherein said one or more vent passages are of a diameter between 20 and 50mm.

17. A vehicle safety seat according to any one of the preceding claims wherein said means responsive to an accident situation is a deceleration detector.

18. A vehicle safety seat substantially as herein described with reference to and as shown in Figures 1 to 4 of the accompanying drawings.

19. A vehicle safety seat substantially as herein described with reference to and as shown in Figure 5 of the accompanying drawings.

20. A vehicle safety seat substantially as herein described with reference to and as shown in Figure 6 of the accompanying drawings.

21. Any novel feature or combination of features disclosed herein.

The Patent Office

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Application No: GB 9705453.0
Claims searched: 1-20

Examiner: J. C. Barnes-Paddock
Date of search: 15 May 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B7B (BSB) A4L (LBEQ LBRG)

Int Cl (Ed.6): B60N 2/42
B60R 21/16, 22

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	GB 2,290,505 A	(VOLKSWAGEN) See Fig. 1 and Sentence bridging pp 8, 9. Note undersquab airbag module 14 and dashed lines representing inflated position,	1,2,3,7 11,12
A	GB 2,284,393 A	(TOTANI) See Fig. 5 A safety seat where the squab tilts backward upon collision.	
A	WO 92/06861 A1	(AUDI) See Figure a lifting portion of the seat squab to prevent sliding of the occupant.	
Y	US 3,853,334	(GENERAL MOTORS) See Fig. 2 and Col 2, ll 50-65. An airtight airbag module or cell filled with resilient foam.	1,2,3,7 11,12

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.